

ABSTRACT OF THE DISCLOSURE

Integral fiber optic-based condition sensors detect conditions of a composite structure, e.g., a coated wire assembly so as to detect damage or conditions that may damage the same. Preferably, at least one optical fiber sensor having a plurality of Bragg gratings written into the fiber at spaced-apart locations along its axial length is integrated into the electrical insulator coating of a wire, wire bundle or wiring harness. The fiber optic sensor may thus be employed to measure the environmental loads on the electrical wiring including stresses from bending, axial loading, pinch points, high temperature excursions and chemical damage. The system is capable of detecting and locating transient conditions that might cause damage to a wiring system or permanent changes in state associated with damage events. The residual stress in the electrical insulator coating of a wire, wire bundle, or wiring harness are used to monitor the evolution of damage by wear or chaffing processes. Detected stress relief on one or more Bragg gratings will thus be indicative of damage to the insulator coating on the conductor. As such, the magnitude of such stress relief may be detected and used as an alert that the wire insulation is damaged to an unsafe extent.